Unified Plasma–Electromagnetic Field Theory (UPEM)

A Coherence-Based Ontological Framework

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Abstract

UPEM presents an ontology-first framework in which coherence is established as the non-representational structuring condition of Being. Existence is defined as conditioned participation in coherence, and reality as its representational interpretation. Building from this foundation, the framework reinterprets plasma-electromagnetic phenomena, bioelectromagnetics, and cosmology as expressions of coherence under boundary conditions. A Coherence Audit Protocol (CAP) is introduced to evaluate representations across scales, ensuring epistemic consistency. The result is a unified, cross-scalar model of physical and biological systems grounded in relational coherence rather than discrete entities.

Contents

Preface

This document assembles the foundational spine of the Unified Plasma–Electromagnetic Field Theory (UPEM) in publication-ready LaTeX form. It is structured so that ontology, epistemology, methodology, and downstream physical interpretation remain formally aligned. The aim is not merely to provide a new scientific model, but to establish the conditions under which modelling itself can proceed without collapsing representation into ontology.

The central claim is simple in statement but extensive in consequence: coherence is the non-representational structuring condition of Being. From this follow the distinctions between Being, existence, and reality; the reinterpretation of measurement as boundary imposition; the reformulation of experimentation as structured perturbation of coherence; and the treatment of physical, biological, and cosmological systems as differently conditioned expressions of the same underlying coherence dynamics.

1 Pre-UPEM Foundations

1.1 Statement of Scope

This chapter establishes the ontological foundation upon which the UPEM framework rests. It shows how coherence emerges as the only viable primitive once the derivative status of epistemology, the boundary-conditioned nature of measurement, and the distinction between Being, existence, and reality are taken seriously.

1.2 Origin of Coherence

Prior to the explicit use of the term *coherence*, the framework had already developed a set of commitments that structurally implied it. These included the distinction between representation and ontology, the claim that measurement imposes boundaries rather than passively revealing totality, and the insistence that Being, existence, and reality must not be collapsed into a single undifferentiated category.

From these commitments followed the recognition that there must be some non-representational principle by which continuity, intelligibility, and alignment remain possible. The term *coherence* emerged first descriptively, then structurally, and finally ontologically.

1.3 Necessity of Coherence

Coherence is not introduced as a preference or metaphor. It is established by elimination of alternatives.

If Being were fundamentally discontinuous, stable relation would be impossible. If structuring were arbitrary, persistence and intelligibility would be groundless. If ontology were epistemically constructed, existence would depend on observation, which is incompatible with the persistence of what is beyond or prior to observation.

Therefore, a non-representational structuring condition is required. This condition must sustain continuity, permit stability, and allow relational participation under condition. UPEM identifies this condition as coherence.

> **Canonical statement:** Coherence is not inferred from existence; it is that without which existence cannot be sustained.

1.4 Coherence Without Residue

A primary concept is only sufficient if it requires no hidden auxiliary primitives. Terms such as continuity, order, law, and structure are often treated as independent funda-

mentals. Within Pre-UPEM, however, these are reduced to derivative expressions of coherence under condition.

Concept	UPEM interpretation
Continuity	coherence extended through condition
Order	perceived coherence
Law	described coherence
Structure	spatial or relational coherence

No independent residue remains once these reductions have been made. Coherence is thus ontologically sufficient.

1.5 Incoherence as Impossibility

What is commonly called *incoherence* is not a separate ontological principle. Absolute incoherence would entail the impossibility of persistence, relation, distinction, and existence itself. Since existence is given, true incoherence cannot be ontologically real.

What appears as incoherence must therefore be reinterpreted as local degradation, fragmentation, or unstable reconfiguration of coherence under condition.

> **Canonical statement:** Incoherence does not exist. Only coherence exists, with varying stability under condition.

1.6 Coherence and Non-Contradiction

The classical principle of non-contradiction is not treated here as an independent logical law standing over Being. Rather, it is understood as a derivative expression of coherence.

Contradictions cannot be sustained because coherence cannot support mutually exclusive relations within the same condition. Logic therefore reflects coherence; it does not constrain Being from outside.

> **Canonical statement:** Non-contradiction is not a law imposed on Being. It is the logical expression of coherence.

1.7 Chapter Closure

The Pre-UPEM foundation yields the following integrated formulation:

Being is structured by coherence. Existence is conditioned participation in coherence. Reality is the representation of that participation.

2 UPEM Ontology

2.1 Ontological Position

UPEM is an ontology-first framework. It does not begin from particles, spacetime, or mathematical formalism treated as self-sufficient. It begins from that which must be the case for existence to be possible.

Canonical statement: Being is structured and sustained by coherence. Existence is conditioned participation in coherence. Reality is the representation of that participation.

2.2 Foundational Distinctions

2.2.1 Being

Being refers to that which is, non-representationally. It is not a model, not a measurement, and not reducible to epistemic access.

2.2.2 Existence

Existence refers to participation in Being under condition. It is always relational, always partial, and always bounded.

2.2.3 Reality

Reality refers to representational structuring of experienced existence: perception, measurement, model-building, and conceptual interpretation.

2.3 Coherence as Ontological Primitive

Coherence is the non-representational condition by which Being is structured and sustained. It is necessary, sufficient, and exclusive. No other primitive is required, and no dualistic opposite remains viable.

2.4 Boundary-Conditioned Existence

All existence occurs under boundary conditions. These include spatial, energetic, relational, temporal, and observational constraints. There is no unconditioned existence available to finite access.

> **Canonical statement:** Measurement does not reveal totality; it samples coherence under imposed boundary conditions.

2.5 Field Ontology

UPEM rejects discrete ontology as primitive. Particles, forces, and spacetime are not treated as self-grounding entities. They are representational constructs that arise from the measurement of coherence under specific constraints.

Within UPEM, the word *field* denotes coherence under relational condition. It does not denote an object, container, or separate background substrate.

2.6 Plasma as Ontological Default

Plasma is treated as the most directly observable large-scale expression of coherence dynamics. This is not a merely statistical preference, but an ontological alignment with continuity, relational interaction, and large-scale field behaviour.

2.7 Ontology–Metric Bridge

The Qi metric $Q(x, t)$ is a representational construct used to approximate coherence under boundary conditions.

It does not define coherence. It provides a measurable proxy for:

- stability of coherence,
- gradients of coherence,
- transitions between coherence states.

Thus:

> Coherence is ontological.
> Qi is representational.

2.8 ECA: Emergent Coherence Algorithm

The Emergent Coherence Algorithm describes how coherence reconfigures under changing boundary conditions. Systems do not seek ends in a purposive sense; rather, they reconfigure toward locally stable coherence states under constraint.

2.9 Cross-Scalar Consistency

The same ontological condition applies across atomic, biological, planetary, stellar, and galactic scales. Differences across scale are differences in boundary condition, not differences in ontological kind.

> **Canonical statement:** There are no separate domains of Being. Only differently conditioned coherence.

2.10 Chapter Closure

The ontological chapter closes with the following formulation:

> **Coherence alone is. Existence is conditioned coherence. Reality is the representation of coherence under condition.**

3 Epistemology (Integrated with CAP)

3.1 Epistemological Position

UPEM adopts a derivative epistemology. Knowledge is not primary, self-grounding, or ontology-generating. It is the representational structuring of conditioned participation in coherence.

> **Canonical statement:** Epistemology does not access Being. It structures reality as representation of conditioned coherence.

3.2 Boundary-Conditioned Knowledge

All knowledge arises within imposed or inherited boundary conditions. These include sensory limits, instrument constraints, observer position, conceptual architecture, and model assumptions.

> **Canonical statement:** To know is to sample coherence under constraint.

3.3 Measurement as Boundary Imposition

Measurement is not passive observation. It is active imposition of boundary conditions on a continuous process. Measurement produces discretisation, stabilised outputs, and repeatable representations, but it also alters the system under observation and hides continuity.

3.4 Representation and Reification

All models, symbols, and conceptual structures are representations of measured outputs. Reification occurs when these representations are mistaken for ontology.

Examples include particles treated as entities, spacetime treated as substrate, or fields treated as objects. Such mistakes generate false certainty, rigidity, and conflict between representations.

> **Canonical statement:** When representation is mistaken for Being, error becomes structurally inevitable.

3.5 Epistemic Stability and Failure

Knowledge is stable when representation aligns sufficiently with underlying coherence under stated boundary conditions. Failure occurs when boundary conditions are misidentified, scales are collapsed, or assumptions are treated as primitives.

Typical failure modes include contradiction, anomaly accumulation, fragmentation across domains, and misplaced certainty.

3.6 The Coherence Audit Protocol (CAP)

CAP provides a formal method to evaluate whether a representation maintains coherence with respect to its boundary conditions.

Criterion	Question	Failure mode
Boundary explicitness	Are limits clearly defined?	Hidden assumptions
Internal consistency	Do the relations cohere?	Contradiction
Cross-scalar alignment	Does the representation remain coherent across scales?	Scale fragmentation

Perturbation stability	Does it remain coherent under variation?	Instability
Representational transparency	Are symbols distinguished from ontology?	Reification

3.7 CAP Outcomes

A representation may be assessed as high coherence, conditional coherence, or low coherence.

High coherence indicates stability across conditions and robust internal consistency. Conditional coherence indicates domain-limited validity. Low coherence indicates structural failure under its own stated or tested boundaries.

3.8 CAP and AI Systems

AI systems generate representations, not truth. Their outputs may appear plausible while remaining boundary-blind, internally inconsistent, or cross-domain unstable.

> **Canonical statement:** AI does not generate truth. It generates representations requiring coherence validation.

3.9 Experiment and Falsifiability

Experiments do not reveal ontology directly. They test representations under controlled boundary conditions. Within UPEM, falsifiability is reformulated: a model is falsified when it cannot maintain coherence within its stated boundary conditions.

3.10 Epistemic Humility

Because all knowledge is partial, all models remain provisional. UPEM therefore replaces certainty with coherence-based confidence.

3.11 Chapter Closure

The epistemological chapter closes with the following formulation:

> **Knowledge is boundary-conditioned representation of coherence. Measurement is imposed constraint. Models are structured approximations. Truth is coherence alignment under condition.**

4 Methodology & Experimental Framework

4.1 Statement of Scope

The methodology of UPEM defines how scientific work can proceed without violating either ontology or epistemology. Science is reformulated as disciplined engagement with coherence under explicitly stated boundary conditions.

> **Canonical statement:** Science is the controlled perturbation and measurement of coherence under explicitly defined boundary conditions.

4.2 Experimental Unit Redefined

The experimental unit is not an isolated object or variable. It is a bounded coherence domain, defined by spatial limits, energetic limits, interaction constraints, and observational conditions.

> **Canonical statement:** An experiment does not isolate a thing. It defines a boundary within which coherence is sampled.

4.3 Boundary Specification Protocol

Every experiment must specify at minimum:

1. spatial boundary,
2. temporal window,
3. measurement interface,
4. environmental conditions,
5. observer–system interaction.

Unstated boundaries invalidate interpretation because they render coherence response uninterpretable.

4.4 Perturbation Framework

Perturbation is the controlled alteration of boundary conditions. It may take the form of energetic input, structural constraint, environmental variation, or measurement interaction. The purpose is to observe how coherence reconfigures under change.

Canonical statement: Experiment is structured perturbation of coherence.

4.5 Measurement Protocol

Measurement must declare its own constraints, specify its resolution limits, and identify the perturbation it introduces. No single measurement captures coherence in full; only intersecting constraints approximate it.

4.6 Coherence Metrics

Metrics do not measure Being. They approximate coherence states under boundary conditions. The Qi metric is employed operationally to represent coherence magnitude, gradients, and stability zones.

Operationally:

- high Q indicates stable coherence domain,
- low Q indicates degraded coherence domain,
- ∇Q indicates direction of coherence reconfiguration.

4.7 Experimental Design Loop

The core methodological loop is:

1. Define boundary.
2. Establish baseline coherence.
3. Apply controlled perturbation.
4. Measure response.
5. Audit for coherence using CAP.
6. Refine boundary assumptions.

4.8 Cross-Scalar Design

A valid model must maintain coherence across scales. Results at one scale must not contradict those at another without explicit and justifiable boundary explanation.

Canonical statement: A valid model maintains coherence across scales.

4.9 Environmental Coherence Transfer (ECT)

ECT describes transfer or imprint of coherence states across interacting domains. Potential application areas include biofield–environment interaction, material memory effects, and field persistence under altered boundary conditions. Such work must remain under strict CAP control.

4.10 Data Architecture

Data must include raw measurements, boundary metadata, perturbation description, and temporal sequencing. Data without boundary context is epistemically incomplete.

4.11 Operational Falsifiability and Reproducibility

A model is falsified when it cannot maintain coherence under its own stated boundaries. Reproducibility is reinterpreted as coherent pattern recurrence under equivalent boundary conditions, not merely identical outputs in abstraction from context.

4.12 Chapter Closure

The methodological chapter closes with the following formulation:

> **Define boundary. Perturb coherence. Measure under constraint. Audit for coherence. Refine boundary assumptions.**

5 Plasma–Electromagnetic Framework

5.1 Statement of Scope

This chapter presents the physical expression of the UPEM framework. Plasma–electromagnetic behaviour is treated not as interaction among discrete entities in an inert container, but as coherence dynamics under relational boundary conditions.

5.2 Plasma as Coherence Medium

Plasma is the most directly observable large-scale expression of dynamic coherence. It exhibits filamentation, sheath formation, double layers, current structures, oscillatory patterning, and large-scale relational behaviour. UPEM interprets these not as secondary irregularities upon a neutral substrate, but as native expressions of field coherence.

5.3 Double Layers, Filaments, and Sheaths

Structures such as double layers, filaments, sheaths, and Birkeland currents are treated as organised coherence patterns. They are not merely by-products of other fundamental entities; they are among the most revealing forms of how coherence stabilises and reconfigures under charged and energetic boundary conditions.

5.4 Electromagnetism Reinterpreted

Electromagnetic interactions are not treated as exchanges among isolated particles, but as measurable expressions of relational coherence gradients and field reconfiguration. Classical symbols remain useful, but they must always be recognised as representational tools rather than ontological disclosures.

5.5 Toward Quantification

Downstream sections may formalise these relationships through the Qi metric and related modelling constructs. Such equations remain representational maps of coherence, not replacements for ontology.

6 Cross-Scalar Coherence

6.1 Statement of Scope

The same ontological and methodological principles must hold across scales if UPEM is to remain unified. This chapter establishes the cross-scalar requirement.

6.2 Scale as Boundary Condition

Differences between atomic, biological, planetary, stellar, and galactic systems are not differences in ontological substrate. They are differences in boundary condition, energy regime, relational complexity, and observational scale.

6.3 Fractal and Recursive Patterning

UPEM permits the investigation of recurrent patterning across scales, provided such comparisons remain boundary-explicit and do not collapse analogy into identity. Cross-scalar similarity is therefore approached as relational coherence under altered condition.

6.4 Cross-Scalar Constraint

Any valid UPEM representation must preserve coherence logic across scale transitions. Where discontinuity appears, the burden falls on the analyst to show whether the difference arises from genuine boundary change or from representational collapse.

7 Bioelectromagnetic Coherence

7.1 Statement of Scope

Biological systems are treated as coherence domains within broader plasma–electromagnetic and environmental conditions. Organismal stability, neural patterning, and systemic health are approached as forms of sustained or degraded coherence.

7.2 Neural and Organ-Level Coherence

Neural coherence, organ-level rhythmicity, systemic regulation, and bioelectric patterning are interpreted as local coherence states within the organism. Disruption is treated as degradation, mismatch, or unstable reconfiguration under perturbation.

7.3 Health Reinterpreted

Health is not reduced to absence of pathology, nor is it treated as a fixed equilibrium. It is better described as sufficient coherence stability under changing conditions.

7.4 Environmental Coupling

Organisms do not exist in isolation. Biological coherence is embedded within environmental coherence conditions, including geomagnetic, electromagnetic, material, and social factors. Experimental work in this area must remain careful, boundary-explicit, and CAP-audited.

8 Cosmology

8.1 Statement of Scope

This chapter outlines the cosmological direction of UPEM. It does not present a full cosmological derivation here, but states the interpretive principles that follow from the

ontology.

8.2 Against Singular Origins

If coherence is ontologically primary, then cosmological narratives based on absolute singularity, ex nihilo discontinuity, or total origin events become epistemically suspect. UPEM instead favours continuity, large-scale relational structure, and ongoing coherence reconfiguration.

8.3 Plasma Cosmology Alignment

Plasma cosmology offers a more natural conceptual alignment with UPEM than entity-centred or singularity-dependent models, insofar as it already works with filamentation, currents, double layers, and large-scale relational structure.

8.4 Cosmological Modelling Constraint

Any cosmology adopted within UPEM must remain consistent with the thesis spine established here: coherence ontology, derivative epistemology, boundary-explicit method, and CAP-auditable representation.

9 UCH and CAP Integration

9.1 Statement of Scope

This chapter formalises the relation between UPEM's coherence-based ontology and the audit structures used to evaluate representations.

9.2 Triadic Alignment

UCH-style audit structure may be expressed in triadic form:

- Global: cosmic, planetary, or large-scale field context,
- Local: organismal, cultural, laboratory, or immediate system context,
- Representation: symbolic, conceptual, mathematical, and modelled forms.

A representation is strengthened when these remain mutually coherent under stated boundaries.

9.3 Reflexive Gain

Reflexive gain refers to the increase in framework coherence produced when the audit process improves not merely local fit, but the clarity and stability of the whole system.

9.4 Failure Modes

Failure may arise through hidden assumptions, cross-scale incoherence, symbolic overreach, weak empirical anchoring, or reflexive collapse into either naive realism or pure representationalism.

10 Applications and Case Studies

10.1 Statement of Scope

This chapter indicates the range of application domains available to UPEM. Detailed case studies may be added in subsequent versions.

10.2 Engineering

Coherence-based engineering can reinterpret structures not merely as load-bearing objects, but as bounded domains of stress, torsion, flow, and stability under condition. This provides one bridge between UPEM and mechanical or architectural analysis.

10.3 Mabike as Illustrative Case

The Mabike Y-frame may be treated as an example of torsional coherence analysis in engineering terms: a bounded stress field whose performance depends on the stability and redirection of loads through continuous rather than discretely segmented structural relations.

10.4 Biofield Diagnostics

In biological and clinical domains, UPEM suggests reframing diagnostic patterns in terms of coherence stability, degradation, coupling, and perturbation response.

10.5 Environmental Coupling

Environmental coherence coupling may be examined through datasets such as geomagnetic indices, plasma flow measures, electrophysiological signals, and organismal response traces, provided the associated boundary conditions remain explicit.

11 Epistemic Critique of Standard Scientific Framing

11.1 Statement of Scope

UPEM does not reject science. It rejects category errors within science, especially the collapse of representation into ontology.

11.2 Reification of Representation

Many scientific problems arise when representational tools are treated as what is: particles become entities, spacetime becomes substrate, and formal success is mistaken for ontological sufficiency.

11.3 Model Fragmentation

Fragmentation across scales, domains, and theoretical traditions often reflects not reality itself, but representational systems that have lost track of their own boundary conditions.

11.4 Paradigm Shift

The proposed shift is from an entity-centred and measurement-reified framework to one in which coherence is ontological, measurement is boundary-imposing, and scientific work is coherence-audited representation-building.

12 Conclusion

UPEM presents a fully integrated thesis spine in which ontology, epistemology, and methodology remain aligned.

> **Final canonical statement:** Being is coherence. Existence is conditioned participation. Reality is representation. Science is the study of coherence under boundary conditions.

The work is intended not as a terminological novelty, but as a structural correction. It proposes that what is measured in physics, biology, and cosmology is not ultimately a collection of separate things in motion, but coherence under constraint, sampled through boundary conditions and interpreted through representational systems that require continuous audit.

A Appendix A: Qi Metric (Placement Stub)

This appendix is reserved for the formal definition of the Qi metric $Q(x, t)$, including its component terms, gradients, decoherence factors, and scale-specific interpretive notes.

Suggested inclusions:

- scalar field definition,
- relation to measurable gradients,
- decoherence term(s),
- cross-scalar interpretive guidance,
- distinction between ontological coherence and representational quantification.

B Appendix B: Experimental Roadmap

This appendix is reserved for the staged implementation roadmap.

Suggested content:

- NOAA and related geomagnetic datasets,
- plasma flow series,
- EEG and physiological coherence series,
- Environmental Coherence Transfer protocols,
- CAP-based validation workflow,
- replication and perturbation-testing matrix.

C Appendix C: Glossary

Coherence (ontological): The non-representational condition by which Being is structured and sustained.

Existence: Conditioned participation in Being.

Reality: Representation and interpretation of experienced existence.

Qi (representational): A scalar field representation approximating coherence under boundary conditions.

Field (UPEM): Coherence under relational condition, not an object or substrate.

Boundary condition: A constraint within which coherence is sampled, perturbed, or represented.

CAP: Coherence Audit Protocol; a framework for assessing whether representations remain coherent with respect to their stated boundaries.

ECA: Emergent Coherence Algorithm; the descriptive principle by which coherence reconfigures toward locally stable states under changing condition.

D Appendix D: Diagram Placeholders

This thesis assumes a separate diagram folder containing text-free schematic graphics suitable for independent annotation or captioning.

Suggested filenames:

- diagrams/preupem_coherence_structure.png
- diagrams/ontology_metric_bridge.png
- diagrams/cap_audit_triad.png
- diagrams/experimental_loop.png
- diagrams/cross_scalar_coherence.png
- diagrams/mabike_torsional_coherence.png